The following are detailed comments submitted by the U.S. Environmental Protection Agency in response to Special Public Notice SPN-1995-120 Crooked Creek, Donlin Gold LLC.

The administrative record for the project should clearly document compliance with the Section 404(b)(1) Guidelines.

The Clean Water Act Section 404 regulatory program provides that the U.S. Army Corps of Engineers evaluate applications for the discharge of dredged or fill material into waters of the United States in accordance with the Section 404(b)(1) Guidelines (Guidelines). The Guidelines are codified at 40 CFR 230 and are the substantive environmental criteria used to evaluate proposed discharges of dredged or fill material. Proposed discharges may not be permitted unless they are determined to comply with the Guidelines.

Clearly demonstrating compliance with the Guidelines is the responsibility of the applicant. A proposed discharge is considered noncompliant if the application contains insufficient information to determine compliance[1]. As the permitting agency, the Corps is responsible for determining and documenting whether a proposed discharge complies with the Guidelines[2].

The Guidelines only allow authorization of the Least Environmentally Damaging Practicable Alternative (LEDPA).

The Guidelines at 40 CFR § 230.10 identify several specific restrictions on discharges. The first[3] is that, "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." Once practicable alternatives are determined for a proposed discharge, only the LEDPA may be authorized.

An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purposes[4]. Once the LEDPA has been identified, that is the version of the project which is evaluated against the other restrictions on discharge[5].

As detailed in the FEIS, the current proposal is for the mine vehicles and equipment such as the 300-ton haul trucks to be fueled by diesel. 64 barge trips up the Kuskokwim River would be required to transport diesel to the Jungjuk port site during each open-water season of mine operations, and 37.5 million gallons of diesel would be stored at the mine.

The fuel barge traffic could result in erosion of the Kuskokwim River banks and scour of the bed, with impacts to fish and fish habitat. Three alternatives that would reduce or eliminate the fuel barge traffic during operations were evaluated in the FEIS. Fuel barge traffic to support mine construction would not be affected.

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[1] 40 CFR 230.12(a)(3)(iv)
[2] 40 CFR 230.5 & 33 CFR 332.1(c)(2)/40 CFR 230.91(c)(2).
[3] 40 CFR § 230.10(a)
[4] 40 CFR § 230.10(a)(2)
[5] 40 CFR § 230.10(b), (c), and (d)

As expressed in our earlier letters, Alternative 3A (LNG-powered haul trucks) and Alternative 3B (co-located natural gas and diesel pipelines) would each substantially reduce the total amount of barge traffic necessary to support the mine, resulting in fewer impacts to the Kuskokwim River. Either of these alternatives could represent the LEDPA.

As explained in the FEIS, the use of LNG and compressed natural gas in industrial applications is proven and equipment manufacturers are actively developing duel-fuel options for the mining industry. For example, Caterpillar mine haul trucks in the 793, 795, and 797 series are currently offered with a natural gas fuel option. These trucks use a high pressure direct injection system that allows them to use a 95% LNG/5% diesel fuel mix. The 795 has a 320-ton capacity, while the 797 has a 400-ton capacity. Combined-fuel systems for haul trucks produced by other manufacturers have different ratios.

Project impacts should be evaluated for their potential to cause or contribute to significant degradation.

The Guidelines[6] specify that: "no discharge of dredged or fill material shall be permitted which will cause or contribute to significant degradation of the waters of the United States. Findings of significant degradation related to the proposed discharge shall be based upon appropriate factual determinations, evaluations, and tests required in subparts B and G, after consideration of subparts C through F, with special emphasis on the persistence and permanence of the effects outlined in those subparts."

The referenced subparts of the Guidelines require that direct, secondary, and cumulative impacts be assessed to determine the potential for significant degradation. They establish specific approaches to evaluate four categories of effects. These include effects on: 1) human health or welfare, including but not limited to effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites; 2) the life stages of aquatic life, other wildlife dependent on aquatic environment including the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and chemical processes; 3) aquatic ecosystem diversity, productivity and stability. Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy; or to 4) recreational, aesthetic, and economic values.

The rigor and detail of analysis when evaluating compliance with the Guidelines should reflect the extent, severity, and permanence of predicted project impacts[7]. Donlin Gold has indicated that they will conduct a watershed assessment that will include an evaluation of the potential for significant degradation. The watershed assessment will be submitted as part of a revised compensatory mitigation plan. We applaud Donlin Gold's willingness to take this step, as the impacts associated with the proposed project certainly warrant detailed analysis.

The FEIS indicates that the project will result in significant impacts to Crooked Creek, primarily through the alteration of the flow regime. As we expressed in our earlier letters, these impacts could potentially cause or contribute to significant degradation in violation of 40 CFR §

[6] 40 CFR § 230.10(c)

[7] See, for example, 40 CFR 230.6, introductory sentence in 40 CFR 230.10, and RGL 93-02.

230.10(c). If these impacts were unavoidable, it would be questionable whether compliance with the Guidelines could be demonstrated.

However, Donlin Gold's application materials and the FEIS indicate that the flow impacts to Crooked Creek may be avoided and minimized such that compliance with both 40 CFR § 230.10(c) and (d) may be demonstrated.

The Guidelines require application of the mitigation sequence to minimize impacts.
The Guidelines[8] further specify that "no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem. Subpart H identifies such possible steps."

To evaluate compliance with Section 230.10(d), the Guidelines tell us to "Identify appropriate and practicable changes to the project plan to minimize the environmental impact of the discharge, based upon the specialized methods of minimization of impacts in Subpart H[9]."

The multiple sections within Subpart H (40 CFR § 230.70-.77) identify many possible steps to avoid, minimize, and compensate for direct and secondary adverse impacts. Taken together, these steps form the mitigation sequence: a mandatory, sequential process undertaken to "minimize potential adverse impacts of the discharge on the aquatic ecosystem." As explained in the preamble, the Guideline's use of the term "minimize" includes all categories of mitigation: "Section 230.10(d) uses the term "minimize" to indicate that all reasonable reduction in impacts be obtained. As indicated by the "appropriate and practicable" provision, steps which would be unreasonably costly or would be infeasible or which would accomplish only inconsequential reductions in impact need not be taken[10]."

Demonstrating compliance with Section 230.10(d) requires the applicant to identify the appropriate and practicable steps they will take to avoid, minimize and compensate for remaining unavoidable impacts. Donlin Gold has identified a range of adaptive management measures that could be implemented to ensure that minimum flows in Crooked Creek are maintained. While no specific measure has been proposed, they have identified several potential measures: lining or relocating a portion of the Crooked Creek channel, augmenting Crooked Creek flows from the proposed Snow Gulch reservoir, pumping water from the Kuskokwim River, or grouting areas of bedrock demonstrating high flow rates.

We appreciate Donlin Gold identifying measures that could be taken to minimize impacts to Crooked Creek. The requirement of the Guidelines, however, is not to "ensure minimum flows in Crooked Creek." Aquatic resource impacts must be avoided and then minimized to the maximum extent practicable. This means that measures must be taken now, rather than as contingencies. The operative question is not whether flow impacts to Crooked Creek will be greater than currently predicted, but whether it is practicable to avoid or minimize the predicted impacts.

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[8] 40 CFR § 230.10(d)
[9] 40 CFR § 230.5(j)
[10] 45 Fed. Reg. 85344 (1980)

Mitigation, monitoring, and adaptive management measures are presented in Chapter 5 of the FEIS. Tables 5.5-5.7 include information about whether individual measures are reasonable/practicable; whether they are likely to be effective; and whether they are likely to be implemented.

Lining or relocating a portion of the Crooked Creek channel may be practicable. This measure would prevent flow loss from the channel into the alluvium and then to the dewatering wells, but would not result in a net reduction in impacts to Crooked Creek. The alluvial aquifer would still be dewatered, and isolating the stream channel from the alluvium, from its floodplain and associated riparian wetlands, would result in different but equally serious impacts. As the stage maintenance pumping of the pit lake post-mining will maintain hydraulic gradients that draw water from the alluvium in perpetuity, any alteration of the Crooked Creek channel would need to be permanent.

Releasing water from the proposed Snow Gulch reservoir would be practicable, at least early in the mine life and during the summer high flow periods. While such releases would reduce the Crooked Creek flow losses specifically associated with the Snow Gulch reservoir, they would not avoid the bulk of the predicted Crooked Creek flow losses through the alluvium to the dewatering wells. It is also questionable how much water could be released from the reservoir during the periods of greatest cumulative flow loss, which are during the winter later in the mine life. The freshwater reservoirs are specifically intended to provide process water during these periods when other water sources are limited.

Table 5.5 of the FEIS suggests that sourcing water for mine operations from the Kuskokwim River would not be practicable because of the potential for the introduction of invasives and non-endemic pathogens. This appears to conflict with other information in the FEIS. Chapter 3.10 states that 27 nonnative invasive terrestrial plant species have been recorded in the project area: 12 at the mine site, 21 along the transportation corridor, and 15 along the pipeline route. This chapter explains that virtually all the proposed mine components have the potential to increase the spread of nonnative invasive terrestrial plants, but does not suggest that this risk affects practicability.

Unlike the case for invasive terrestrial plants, the FEIS suggests that there are no aquatic organisms of concern that might exist at the confluence of Crooked Creek with the Kuskokwim River but not near the mine site. Chapter 3.10 states that "There are no known reproducing populations of nonnative invasive marine or freshwater aquatic plants, fish, or animals…within the Project Area." The FEIS also states that nonnative invasive pathogens currently are "either not known to occur in Alaska or are not considered serious threats to public health."

As discussed above, the pros and cons associated with an alternative do not determine whether it is practicable within the context of the Guidelines. The relevant question is whether an alternative is "available and capable of being done."

Table 5.5 indicates that the purpose of pumping water from the Kuskokwim River would be to supplement the Crooked Creek flow to offset the dewatering losses. The primary reason to pump water from the Kuskokwim River would be to ensure an adequate supply of water for mine

operations. All contact and process water from the mine will be treated prior to discharge, which should reduce the risk of nonnative introductions.

According to Chapter 2 of the FEIS, the ore processing plant for the Donlin mine would require approximately 18,000 gallons per minute (gpm) on average over the life of the mine. Sourcing water from off-site is not uncommon for metal mines, like Donlin, that have substantial water needs. For example, the Casino project in the Yukon Territory near Whitehorse is a proposed copper, gold, molybdenum, and silver mine currently undergoing environmental review. The Casino mine proposes to source water from the Yukon River eleven miles away via an insulated, aboveground 36-inch diameter pipeline with a 15,000 gpm capacity.

Outside of the mining industry, the use of insulated pipe on vertical support members to transport treated seawater for tens of miles for injection at production pads is a common practice on Alaska's North Slope.

Sourcing water from the Kuskokwim River would eliminate the need for the proposed freshwater reservoirs, and the tributary flows could be diverted to Crooked Creek to avoid flow losses. Treated water discharges could be to the alluvial aquifer via percolation pits rather than to the channel to reduce the potential for bed scour and bank erosion. If flow augmentation was identified as desirable, and testing indicated that there was no risk, water from the Kuskokwim River could be discharged to these same authorized locations to actively maintain the Crooked Creek hydrograph.

Installation of a cutoff wall as discussed below would reduce flow losses from dewatering, and dewatering volumes could be re-directed to Crooked Creek as they would not be needed for ore processing. These combined measures would avoid most of the flow impacts to Crooked Creek.

A grout curtain could be installed to protect Crooked Creek and its alluvial aquifer from the effects of the proposed drawdown wells and mine pit development. Data in the FEIS suggests that a two-phase cutoff wall using a trench cutter would be effective in preventing flow loss from the alluvial aquifer. To be effective, the cutoff wall would need to extend over the area where the drawdown wells would capture flow from the alluvial aquifer. Rather than grouting some bedrock fractures, this would require a wall of approximately 2.3 miles in length with an average cut depth of about 35 feet.

A cutoff wall of the size necessary may take several years to install. By way of comparison, the cutoff wall installed at the Red Dog Mine back dam was begun in 2007 and completed in 2009. Using the same installation rate as at the Red Dog Mine, the hypothetical grout curtain at Donlin mine would take just over two years to install.

All the adaptive management measures proposed by Donlin Gold to address the Crooked Creek flow losses would require extended time periods to implement. This makes them better suited to being incorporated into the mine design and construction than implemented as contingencies during mine operations. The multi-year installation of a cutoff wall would best be accomplished during the 3 to 4-year mine construction phase. Ideally, it would be completed prior to the

initiation of dewatering, as the hydraulic stress from dewatering would potentially destabilize the trenches.

As mentioned just above, the stage-maintenance pumping of the pit lake post-closure would continue to draw flow from Crooked Creek in perpetuity. A cutoff wall has a limited operational life, and would need to be maintained over time to continue protecting the alluvial aquifer.

Chapter 5 of the FEIS identifies other potential measures to reduce impacts to Crooked Creek. These include installation of a well field on the west side of Crooked Creek to supplement flow loss from dewatering with pumped groundwater, and relocating treated water discharge points upstream of the area of greatest flow loss.

The unavoidable project impacts to aquatic resource function should be fully offset. Compensation is the third step of the mitigation sequence, and appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts which remain after all appropriate and practicable minimization has been accomplished. All direct and secondary impacts should be offset, including the temporal functional loss from non-permanent impacts. In the Section 404 regulatory program, compensatory mitigation is defined as the restoration, establishment, enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved[11].

The Guidelines identify that "[c]ompensatory mitigation requirements must be commensurate with the amount and type of impact that is associated with a particular DA permit[12]." They also specify that "the amount of required compensatory mitigation must be, to the extent practicable, sufficient to replace lost aquatic resource functions. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used[13]."

A mitigation ratio greater than one-to-one must be used when preservation is the method of compensation, and to address issues such as: differences between the functions lost at the impact site and the functions produced by the compensatory mitigation project, temporal losses of aquatic resource functions, and/or the distance between the affected aquatic resource and the compensation site[14].

Maintaining the ecological sustainability of watersheds by fully offsetting impacts is critical to achieving the Clean Water Act's objective to restore and maintain the chemical, physical, and biological integrity of the Nation's waters, and is necessary to support and connect fish and wildlife habitat, and to support human uses such as commercial fisheries and subsistence.

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[11] 40 CFR § 230.92
[12] 40 CFR § 230.93(a)(1)
[13] 40 CFR § 230.93(f)(1)
[14] 40 CFR § 230.93(f)(2) and (f)(3)

The regulations[15] require applicants to prepare a mitigation plan for proposed compensation activities, and the mitigation plan must be approved prior to permit issuance. Donlin Gold submitted a conceptual compensatory mitigation plan (CMP) which was incorporated into the DEIS as Appendix M. A revised CMP was submitted in December of 2017. It is our understanding that Donlin Gold will continue to work with the District to revise its CMP as necessary.

The current CMP includes proposals for two permittee-responsible projects. One project is stream restoration in the Crooked Creek watershed near the proposed mine site. The second project is preservation of streams and wetlands in the Chuitna River watershed.

The proposed stream restoration project is located just upstream of the Donlin Gold mine site. The project would address historic placer mining impacts to Ruby and Queen gulch, which are tributaries of Crooked Creek, and to Quartz and Snow gulch, which are tributaries of Donlin Creek. Inclusive of riparian buffers, the project is approximately 172 acres. The proposed restoration has the support of the surface and subsurface owners, which are The Kuskokwim Corporation and Calista Corporation, respectively, as well as the current leaseholder.

The proposed preservation project would place deed restrictions on approximately 5,888 acres of land owned by the Tyonek Native Corporation and the Alaska Mental Health Trust Authority. The parcels include approximately 2,558 acres of wetlands, 2,994 acres of upland riparian and floodplain habitat, and 43 miles of streams. The stream miles include 19.8 miles of the Chuitna River, over five miles of Lone Creek, and several miles of Lone Creek tributaries.

The proposed preservation parcels are located on the west side of Cook Inlet, within the Cook Inlet Basin ecoregion. The preservation project is proximal to the natural gas pipeline route (Beluga option), but the majority of aquatic resource impacts from the Donlin Gold mine would occur on the other side of the Alaska Range within the Kuskokwim Mountains ecoregion.

Evaluation of the proposed compensation should be based on functional losses and gains. As referenced above, the Guidelines encourage the use of function or condition assessments to determine the amount of compensation that would be sufficient to offset the authorized impacts. Function and condition assessments provide tools to quantify the extent of functional loss (debits) and functional gain (credits). Debits represent the loss of function at the impact site, while credits represent the accrual or attainment of aquatic functions at a compensatory mitigation site.

The use of debits and credits is important because ratios based only on acres or linear-feet almost always result in a net loss of aquatic resource function. The net loss occurs because direct impacts within a fill footprint may result in a complete loss of function for the affected acres, while the functional gains from restoring, enhancing, or preserving aquatic resources tend to be smaller and incremental. The more limited functional losses caused by secondary impacts are more comparable to the gains from compensation. Specific to credit production, the Guidelines state that "[t]he number of credits must reflect the difference between pre- and post-

[15] 40 CFR § 230.94(c)(1)(i)

compensatory mitigation project site conditions, as determined by a functional or condition assessment or other suitable metric[16]."

The Alaska District adopted a Credit Debit Methodology (CDM) in September of 2016. The CDM uses function or condition data to quantify the functional losses or gains between the current and proposed future condition. These functional deltas are used to calculate debits and credits, as recommended by the regulations.

The CDM also incorporates the requirements for the use of preservation found at 40 CFR § 230.93(h), including that the preserved resources provide important physical, chemical, or biological functions for and contribute significantly to the ecological sustainability of the watershed. The CDM explicitly quantifies the importance of the preservation site for the watershed, the threats to the site, and the functional lift associated with the preservation. The incorporation of these elements strongly influences the number of calculated credits from preservation projects, and results in an effective mitigation ratio for the use of preservation much greater than 1:1.

We believe that the District's Methodology, or at least a consistent approach, should be used to support decisions about compensation for this project.

Donlin Gold's CMP does not use functional data to quantify project impacts or the functional gains from their proposed compensation projects. Extensive functional data were collected for the areas of the proposed project components, and included in the DEIS. These data, or revised data, or even best professional judgment, could be used to calculate project debits.

Our understanding is that sufficient baseline data exists for the proposed stream restoration sites to quantify functional lift. Regarding the proposed preservation project, we support the collection and use of function or condition baseline data for calculating the number of credits that the proposed preservation would generate. Where appropriate quantitative assessment tools are available, the regulations require their use to determine the contribution of resources that would be preserved to the ecological sustainability of the watershed[17]. Functional assessment data have consistently been used to calculate credits for preservation projects in Alaska. Diverging from this practice would be counter to the intent of the regulations.

Donlin Gold's CMP does not use the District's CDM or other method to calculate debits and credits. Instead, the CMP compares the acres and linear feet of their direct, permanent impacts with the acreage and linear feet of their compensation projects. The current CMP does not propose to offset all of the aquatic resource functional loss associated with the project. Nor would the proposed compensation generate sufficient functional lift to fully offset even the subset of project impacts, when evaluated consistent with District practice.

In addition, the current CMP does not propose the use of available third-party credits, although we understand that Donlin is considering the purchase of credits to offset impacts within the Matanuska-Susitna Borough along the pipeline route. The use of third-party credits is presumed

[16] 40 CFR § 230.98(o)(3)
[17] 40 CFR § 230.93(h)(1)(ii)

to be practicable, and the regulations establish a rebuttable presumption that third-party credits are environmentally preferable to permittee-responsible mitigation due to the lower risk associated with their use. Mitigation bank and in-lieu fee compensation projects are considered as more likely to: address watershed needs, be implemented successfully, and be ecologically sustainable.

The CMP addresses the practicability of several specific potential compensation projects. It does not, but should, address why the proposed compensation is environmentally preferable. The discussion of what is environmentally preferable should address the proposed use of out-of-kind compensation, and compensation that is outside of the watershed.

Credits are generally restricted in use to the area where they can effectively compensate for adverse environmental impacts[18]. The CMP should address how the proposed preservation would effectively offset the authorized impacts, given that the preservation project is not within the same ecoregion as most of the project impacts. As referenced above, the regulations identify that proximity to the impact site is a legitimate consideration when evaluating proposed compensation and in calculating credits. We believe that when and how out-of-watershed compensation is allowed should be a matter of consistent District practice.

Stream assessment tools should be used to assess changes in stream function.
As we have expressed in comments on other projects, functional losses and gains to streams should be assessed analogously as functional losses and gains to wetlands. Provided that the approach to assessing function or condition is analogous between methods, we are unaware of negative implications of using resource-specific assessments for wetlands, streams, and marine resources. Resource-specific assessments generally provide outputs with greater accuracy and precision than more generic assessments which are applied to a variety of resource types.

The EPA contributed to the development of the Stream Functions Pyramid Framework, and has been promoting use of this approach nationally. We have been working with state and federal agencies in Alaska to facilitate use of the Framework by collecting reference data and providing training. The Bureau of Land Management has implemented multiple stream restoration demonstration projects using the approach, with plans for additional projects. The National Park Service also plans to use the Framework to design stream restoration projects.

Like many wetland assessment approaches, the Stream Functions Pyramid Framework measures the condition of multiple variables relative to reference data to infer functional performance. An associated Stream Quantification Tool is used to measure the change in condition and quantify the relative degree or delta of functional gains or losses. This delta may be used as input for the District's Credit Debit Methodology to calculate the credits or debits associated with specific activities. The assessment area for the Framework and SQT includes the stream channel, floodplain, and channel migration zones. Because of this, stream credits and debits may be acre-based, making them directly compatible with acre-based wetland credits and debits. If desired, the stream credits and debits can be converted to use a linear foot metric rather than acres.

[18] 40 CFR § 230.98(d)(6(ii)(A)

We recommend that the functional gains attributed to the proposed stream restoration to be quantified using the Framework and SQT, or a similar stream assessment method. We further recommend that the functional delta generated by the stream assessment be used with the District's CDM to calculate the credits that would be produced by the compensation project.

Out-of-kind compensation may be environmentally preferable.
The Guidelines require the district engineer to identify what form of compensation would be environmentally preferable, and to use a watershed approach for compensatory mitigation decision-making, to the extent appropriate and practicable[19]. The district engineer should consider relevant environmental factors and appropriate locally developed standards and criteria when determining the appropriate watershed scale in guiding compensation activities.

In-kind compensation projects are more likely to be effective in directly offsetting authorized impacts, but the watershed approach may indicate that out-of-kind compensatory mitigation will better serve the high-priority aquatic resource needs of the watershed. This may be particularly true where specific resource types are uncommon, are of high value relative to other types, or if the historic impacts within the watershed were to a different type of aquatic resource than what is affected by current activities. The rationale for any out-of-kind compensation should be documented in the administrative record for the permit action[20].

In this case, the proposed stream restoration would be proximate to the authorized impacts. It would also address cumulative impacts to stream function in the watershed which have accrued over time, and which have generally not been offset. In addition, restoration of aquatic resources results in active functional lift, while preservation results in passive lift and a net loss in aquatic resource area and function.

[19] 40 CFR § 230.93(c)(1)
[20] 40 CFR 230.93(e)(2)